REMARKS

This Response addresses the issues raised by the Examiner in the Office Action mailed June 3, 2004 and covers the telephonic interview between Applicants, Applicants' representatives and the Examiner on August 26, 2004. In view of the above amendments and the following remarks, Applicants feel that all outstanding issues have been addressed, and prompt allowance of the remaining claims is respectfully requested. Restricted Claims 100-107 have been cancelled herein.

The June 3, 2004 Office Action

Applicants received a Final Office Action dated June 3, 2004. In this Office Action, the Examiner rejected Claims 34-35, 37-38, 59-61, 63, 68, 97-98 and 108 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,865,703 to Jagannathan ("Jagannathan"). The Examiner also rejected Claims 36, 39, 62, 64-67, and 99 (the remaining asserted claims) under 35 U.S.C. § 103(a) as being unpatentable over Jagannathan alone or in combination with U.S. Patent No. 5,175,928 to Grabbe ("Grabbe") and "Electrophoretic Deposition – A Review" ("Gani"). Upon close examination of the rejection, the Examiner appears to have merely reasserted previous rejections that were addressed in the Response and Amendment filed February 9, 2004. Because Applicants believe that the Examiner did not give due weight to the claim terms as they are used in the relevant art, Applicants held a telephonic interview with the Examiner.

The August 26, 2004 Interview

On August 26, 2004, a telephonic interview was held between the Examiner and the lead inventor (Dr. Jonathan Van Tassel), Applicants' counsel (Robert Kucler) and representatives of the Assignee (Ruth Harpster and Matthew Smith). In the interview, Applicants explained the nature of the particulate tape

arts, the difference between common electrophoretic deposition coating applications (Jagannathan) and the present creation of a particulate tape via electrophoretic deposition, and the difference between a "carrier" and a "substrate" as used in the particulate tape arts. Applicants also compared the use of binders in particulate tapes to those of other arts, such as coating applications. The following is a reiteration and elaboration on two central issues, the distinction between a "carrier" and a "substrate", and the purpose and necessity of an added binder to the system.

a) Carrier/Substrate Distinction

After a brief introduction to the particulate tape arts (*see* below), including showing the Examiner examples of literature and samples of particulate tapes, Applicants described the difference between the claim term "carrier," as used in the particulate tape arts, from the term "substrate" as used in coating applications such as Jagannathan. In the particulate tape arts, a carrier is an object which has a surface on which a particulate tape is formed. The carrier may be used to hold the tape in subsequent process steps, but it is not incorporated into the particulate tape. A carrier serves only as a temporary "scaffold" on which the particles are formed by various processes into a particulate tape which is then removed from the carrier. This removal can be effected, for example, by mechanical separation, dissolution, or decomposition of the carrier.

For the purposes of this application (*see, e.g.,* Claim 108), at least one component of a particulate tape must be formed by electrophoretic deposition (EPD). The nature of the EPD process requires that there be an electrically conductive area on the surface of the carrier (*see* Claim 108, line 3) onto which the particles can be formed by EPD. Since this electrically conductive area is part of the carrier, the particles formed by EPD must necessarily be removed from this electrically conductive area as well.

If particles are formed onto the surface of an object but are not subsequently removed from that object, that object cannot be considered a carrier. Without removal, this process does not describe the formation of a particulate tape, but the formation of a particulate coating on a substrate (*e.g.*, Jagannathan). The significant distinction is that a carrier is only a temporary aid to manufacturing, whereas a substrate is not only an aid to manufacturing but is incorporated into the final part. As a component of the final part produced, a substrate does not have the temporary nature of a carrier.

The present claims specifically include this carrier/substrate distinction in several places. For example, Claim 108, line 3, states "*providing a carrier which includes an electrically conductive area on at least one surface of the carrier.*" Moreover, Claim 108 concludes with the step of "*removing said particulate tape from said carrier.*" Both of these phrases distinguish the present invention (particulate tape) from the coating applications of Jagannathan as described above and as described in more detail in the Response and Amendment of February 9, 2004.

b) Binder Discussion

The disparate use of binders in the particulate tape arts, when compared to the coating arts, was also discussed briefly. It was noted that the purpose of the binder in Jagannathan is to better bond the particles formed by EPD to the electrically conductive surface onto which they are formed, the "substrate". This is very different from the purpose of a binder phase in this application which is to facilitate the removal of the particulate component formed by EPD from the conductive surface on which it is formed.

A binding mechanism in a particulate tape can serve three purposes: to bond particles to one another, to maintain the particles' configuration relative to

one another, and/or to provide adhesion to another surface to facilitate removal from the carrier. A binding mechanism can be: a binder material added to a particulate component of a particulate tape, partial sintering of the particulate component, or chemical or electrostatic bonding between the particles.

Where particles touch in a particulate tape they are held together by chemical bonds, electrostatic attraction and the van der Waals force. However, for particles larger than 50-100 nanometers, these forces are too weak to allow the tape to be processed to form a component. For example, the van der Waals force, with a range of only 10 to 20 nanometers, will only act on a small portion of the volume of a 200 nanometer diameter particle.

As a consequence a binder must be added to keep the particles in the form of a tape during processing and lamination. Since this binder is only present to aid processing, it is almost always burned out prior to sintering of the particulate material. This burn out step can be slow, difficult and expensive. To our knowledge, all particulate tapes produced today consist of particles held together by a polymer binder.

One of the advantages for the use of EPD in the production of particulate tapes is the potential to produce well-packed tapes of nanoparticulate materials. For tapes made of particles less than 40 nanometers in diameter and especially for particles less than 20 nanometers, the inter-particle van der Waals force will act over the entire volume of a particle. Also the number of interparticle contact points per unit volume will go up as the inverse cube of the particle diameter. A particulate tape of 50 nm particles will have eight times the number of interparticle contact points of a tape made of 100 nm particles, and a tape made of 20 nm particles will have 125 times as many particle contact points per unit

volume. This means that there is an exponential rise in the interparticle contact energies with a decline in particle size. This raises the possibility that tapes formed of nanoparticulate materials may have sufficient strength that they can be handled and laminated without the need for an added binder. This raises the possibility of order of magnitude reductions in processing times as well as the elimination of contaminants associated with a polymer binder and binder burnout, such as residual carbon.

Although an added binder is a necessary component of particulate tapes produced today, this invention has the potential to produce particulate tapes made of purely particulate materials, eliminating the steps of adding and removing a separate binder phase. Therefore, the binder only appears in dependent claims (*e.g.*, Claims 97-99).

Amendment and Response

The discussion that took place during the telephonic interview set forth ample reasons why the present claims are distinguishable over Jagannathan (coating application) and the other cited art. However, in an effort to bring the present prosecution to a successful close, Applicants have decided to further amend the remaining independent claims (Claims 108, 59 and 63) in order to even more clearly point out distinctions with the prior art.

Specifically, the independent claims have been amended to include a limitation that the conductive pattern upon which particles are electrophoretically deposited is a part of the carrier ("wherein said electrically conductive area is a part of said carrier"). Further, the step of removing the particulate tape from the carrier has been amended to specifically state that the particulate tape is removed from the "conductive area of said carrier." In this way, it is clear that the claims refer to a "carrier" as that term is used in the particulate tape arts, as opposed to a

"substrate" used in coating applications. The deposited particulate tape is removed from the "carrier" (including the conductive portion) in the present invention whereas a coating is permanently affixed to the substrate in coating applications (Jagannathan). Although Applicants do not believe that this amendment changes the scope of the claims at issue, the amendment is made for the purposes of clarifying this scope to the Examiner and the reader.

In short, Jagannathan teaches a method for creating a magnetic recording medium that is suitable for perpendicular recording. As shown in Jagannathan's FIG. 15, an electrophoretic deposition bath is used to deposit a thin layer (approximately 10 microns thick – col. 8, lines 17-19) to coat a substrate with an increased packing density. There is no teaching or suggestion in Jagannathan (or in any other reference of which Applicants are aware), of removing the electrophoretically deposited "coating" from the substrate to create an independent particulate tape.

Importantly, Jagannathan has no specific mention of the deposited coating being "removable" from the substrate. A closer reading of Col. 7, line 63 to Col. 8, line 23 of Jagannathan shows that, as with all previous electrophoretic deposition applications, the "coating" is not removed from the carrier (which would make little sense in the context of Jagannathan). The carrier in Jagannathan (the cathode 60) is used as a substrate for the deposition, but the deposited layer is not removed therefrom.

Removing the deposited material from the carrier in order to produce a carrier-independent particulate tape is a key aspect of the claims. Because the deposited component of the present invention exists on its own as a particulate tape or component thereof (infused with a binder), it must have sufficient structure to continue to exist separate from the carrier. This allows the particulate tape to be removed from the carrier as a lone tape, to be sintered and laminated into an existing device stack, or to be utilized in any of a variety of other applications as

described in the specification. Applicants are not aware of any existing reference that describes a process whereby a electrophoretically deposited component is removed from the carrier to produce a particulate tape or component thereof.

Response to Issues Raised in Office Action of June 3, 2004

Although Applicants believe that the above discussion is sufficient to overcome all outstanding rejections, Applicants are providing this additional background information to address certain specific rejections raised by the Examiner in the Office Action dated June 3, 2004.

Regarding the Nature of a Particulate Tape

The preamble of each independent claim includes the following: a method of forming a *particulate tape* (Claim 108); a method for producing a *particulate tape* (Claim 59); and an apparatus for forming a *particulate tape* (Claim 63) (emphasis added). In the field of particulate tape manufacturing, the object that is referred to in these claims as a *particulate tape* is referred synonymously as simply: a *tape*; a *green tape*, indicating that the tape is made up of particles that are not sintered; a *ceramic tape*, when the particles making up the tape are ceramic; or a *cast tape*; a tape produced by casting a particulate slurry. To illustrate the use of the term *tape* in the art, the Examiner was shown sections on tape casting from three textbooks in the field at the August 26, 2004 interview.

Of these terms, *particulate tape* was chosen as most descriptive. To further clarify this term, in the specification, Applicants provided an unambiguous definition: "a *particulate tape* is defined as a ribbon or sheet of one or more particulate materials that are held together, for example, by a polymer binder or matrix." This definition does not specifically exclude a substrate or component made up of a continuous material. However, if objects had to be defined by what they did *not* contain, the definitions would be endless. The fact that there is no

mention of a substrate or a layer of a continuous, *i.e.*, non-particulate, material, indicates that any continuous component must be an insignificant component of the tape.

The process revealed by Jagannathan begins with a pre-existing substrate. Examples of substrates are given as a *flexible web* or *cathode disk*. In the manufacture of magnetic recording media these substrates are commonly continuous layers of polymer or ceramic material. The surface of this *substrate* is then coated with a particulate material by EPD. What is produced by Jagannathan is well defined in the first Jagannathan claim as, "A magnetic recording medium comprising: a. a substrate . . ., b. at least one layer of acicular magnetic particles . . ., c. binder means affixing said particles to said substrate. . . " The substrate is not only a component of the article produced by Jagannathan but is a necessary component. If this layer is necessary, it cannot be considered insignificant. Any definition of a term that comprised the magnetic recording medium of Jagannathan could not exclude mention of the substrate component. The magnetic recording media produced by Jagannathan can be defined as a polymer or ceramic ribbon or sheet with a particulate coating. It cannot be defined as a *particulate tape* as used in the present invention and would not be termed a particulate tape by anyone familiar with the fabrication or use of particulate tapes.

Regarding the Nature of a Component of a Particulate Tape

Furthermore, in the specification of the present application, a definition has been provided to clarify what defines a "component" of a particulate tape: "As used herein, a component of a particulate tape is defined as a spatially defined region of the tape containing particles that have a defined chemistry, morphology, orientation or crystal structure." Since the substrate of Jagannathan is a necessary component of the magnetic recording medium produced, but does not correspond to the provided definition of a component of a particulate tape, the

magnetic recording medium produced by Jagannathan cannot be considered a particulate tape as used in this application.

This distinction is in fact true of all conventional magnetic recording media. The primary component of these media is a continuous substrate material. The particulate coating is less than a few percent of the volume of the media and a negligible portion of the structure of the media. Therefore magnetic recording media as is commonly practiced is not a *particulate tape*. Since what is produced by Jagannathan is not a *particulate tape* as defined in this application or in the existing art, the process described in Jagannathan cannot be considered to anticipate this invention.

Regarding the Nature of a Carrier

Similarly, the first step listed in Claims 59 begin with the words: "providing a *carrier*" and the first component listed in claim 63 is "a *carrier*". The term *carrier* is a term-of-art which is known to anyone who is familiar with the processes used to produce particulate tapes. In the art, the word *carrier* is used to indicate the object upon which a particulate tape is formed and handled, but which is not a component of the particulate tape. As described above, the *carrier* serves only as a temporary scaffold on which the particles can be formed by various processes, necessarily including EPD, into components of a particulate tape which is then removed from the *carrier*. Again the Examiner was provided with the three textbook references for examples of use of the word *carrier* in the relevant art.

Substrate is also a term of art and is also an object which has a surface on which a particulate or other material can be formed. The difference between a *substrate* and a *carrier* is that a *carrier* is not a component of the final product where a *substrate* is. This distinction between a *carrier* and a *substrate* is not always strictly adhered to. *Substrate* is sometimes used as a synonym of *carrier* in the sense that something is formed on a *substrate* and is subsequently removed

from that *substrate*. However, the distinction is explicitly made with respect to the present invention.

Nature of the Components of the Apparatus Revealed in Jagannathan

Jagannathan uses the term *substrate* to indicate an object having a surface on which a component is formed, and which itself forms a component of the item produced. As used by Jagannathan, *substrate* cannot be considered to be synonymous to *carrier*. Since the only surface onto which a particulate material is deposited in Jagannathan is the surface of a *substrate* which is not equivalent to a *carrier*, the process described in Jagannathan does not have the step of providing a *carrier*, and cannot be cited as anticipating the invention.

Although Jagannathan does not use the term carrier, the Examiner has interpreted a component of the apparatus revealed by Jagannathan to be a carrier. The Examiner states "Jagannathan teaches a method and apparatus for producing a particulate magnetic recording media comprising an electrophoretic deposition bath having a *nonconductive carrier* with a conductive *substrate* mounted thereon . . .", "Jagannathan does not explicitly teach removing the recording media from the *carrier* and means associated therewith, nevertheless, this process step and means is implicit in his teachings . . .", and "Jagannathan fairly describes the removal of the substrate . . ."

To identify what the Examiner has called a *carrier*, Applicants refer to Jagannathan's figure 15, "a block diagram of the electrodeposition apparatus according to the invention", it can be seen that his *substrate* is component **60** "a. . . disk cathode, . . . serving as the substrate for the magnetic coating . . . mounted on a nonconductive standoff **62** with a nonconductive spacer **64** separating the anode **58** and cathode **60**." Since the substrate is only directly mounted on and removed from a *nonconductive standoff*, it is apparent that what the Examiner refers to as a *carrier* is what Jagannathan calls a *nonconductive standoff*. There are several

reasons why this *nonconductive standoff* cannot be a *carrier* as defined in the present invention, the simplest and clearest of which comes out of the claims written for this invention. Claims 108 and 59 require "providing a carrier which includes an electrically conductive area on at least one surface of said carrier. . ." and claim 63 requires, "a tape carrier having an electrically conductive surface on at least one surface. . ." The *non-conductive standoff* described in Jagannathan does not include an electrically conductive area on its surface; therefore it cannot be a *carrier* as defined in these claims. If the *standoff* had a conductive area on its surface it would not be nonconductive.

The Examiner argues that mounting a conductive *substrate* onto the *non-conductive standoff* is the same as providing a conductive area on the surface of the standoff. However, mounting a *substrate* onto the *standoff* does not change the fact that the entire area of the surface of the *standoff* remains non-conductive. The only conductive area is on the surface of the substrate.

Objects have surfaces. A surface without an object is a mathematical abstraction. A surface by itself cannot be an object. An area is a subset of a surface. An area by itself cannot be an object. An area must be a subset of the surface of an object. A *substrate* is a physical object; therefore it cannot be an area. A *substrate* on the surface of a *standoff* cannot be considered an area on the surface of the *standoff*. It can cover an area of the *standoff*. It can contact an area on the surface of the *standoff*, but unless it physically changes the substance of the *standoff*, all areas on the surface of the *standoff* will remain non-conductive. So long as there is no conductive area on the surface of the standoff it cannot be considered a carrier for the purposes of this invention. Since Jagannathan does not provide a *carrier* with a conductive area on its surface Jagannathan cannot be considered to anticipate the invention.

A Carrier which is a Mechanical Assembly of Multiple Components

It is possible to hypothesize a *carrier* which is a mechanical assembly of conductive and non-conductive parts. If the *standoff* and the *substrate* provided by Jagannathan are considered as one component, a "*substandoffrate,*" then this assembly would meet the conductive surface area criterion for a *carrier* since this *substandoffrate* would have a conductive area on the *substrate* portion of its surface. However removal of the *substrate* component with the electrophoretically deposited particulate component from the *standoff* component could not be considered removal of the particulate tape from the *substandoffrate.* Disassembly of the *carrier* is not the same as removing a particulate component formed on the *carrier* from the *carrier.* A particulate tape cannot be said to be removed from a *carrier* if bits and pieces of the *carrier* remain stuck to the tape.

However, although we do not consider this a reasonable interpretation of the language used, we would like to make it clear that this is not what is intended in the invention. Therefore we have amended the claims to indicate that the conductive area on the surface of the *carrier* is a part of the *carrier*, and that the *particulate tape,* or component thereof, is removed not only from the *carrier* but specifically from the conductive area of the *carrier* which is necessarily the only area of the *carrier* where particles may be formed by EPD.

Forming a Patterned Components in a Particulate Tape by EPD

In the rejection of claims 37 and 60-61, the Examiner states, "Jagannathan teaches forming a pattern by alignment of the particles as well as providing for an area that does not require magnetic coating, further teaching that the first component can be formed at least partially on top of a second component." However, there is no suggestion in Jagannathan that the deposition substrate is anything other than uniformly and continuously conductive. Therefore, this cannot

be considered to anticipate the use of a patterned conductive electrode on the surface of the carrier.

In the specification "a component of a particulate tape is defined as a spatially defined region of the tape containing particles that have a defined chemistry, morphology, orientation or crystal structure." Since Jagannathan reveals the forming of only one particulate material in one orientation, there is only one component in the process revealed by Jagannathan. Without a second component, the formation of a second component cannot have been anticipated by the teachings of Jagannathan. The substrate in Jagannathan does not contain particles and therefore cannot be considered a component of a particulate tape as defined herein.

The Forming of Conductive Components

In rejecting claim 38, the Examiner states, "The material of Jagannathan is magnetic material and thereby is generally dielectric and conductive . . . " The material in Jagannathan is a ferromagnetic oxide intended for magnetic recording and therefore is generally not conductive. Conductivity in this material would impair or prevent its use as a magnetic recording material. Therefore, this cannot be cited as anticipating the invention as elaborated in claim 38.

The Nature and Purpose of a Binder Phase

In rejecting claims 97-98, the Examiner states: " Jagannathan teaches that his particulate material comprises binder that is dissolved into the bath." The patent of Jagannathan claims: "1. A magnetic recording medium comprising: . . . c. binder means affixing said particles to said substrate surface, . . . " The binder referred to by Jagannathan is intended to permanently affix a coating of particles the surface on which they are formed by EPD, i.e. a *substrate.* Since the stated

purpose of this invention is to remove a component of a particulate tape from the surface on which it is formed by EPD, i.e. a *carrier*, a binder, as suggested by Jagannathan, that would affix the particles to that surface would defeat the purpose of the invention stated here. The purpose of the binder in this invention is to bind the particles in a particulate tape to one another. In the case of a continuous tape this would allow the tape to be removed from the carrier as a completed particulate tape without further processing. This is shown in figures 5A and 7 of this application. A second role of this binder can be to promote the adhesion of the particulate deposition to another surface so that the particulate component could be laminated to that other surface prior to removal of the carrier, as shown in figures 6A and 6B of this application. What the binder in this invention must not do is bind the particles to the *carrier*. Although the materials referred to in this application and in Jagannathan are both correctly called binders, their purpose is so distinctly different that the revelations of Jagannathan cannot be said to anticipate the claims of this invention.

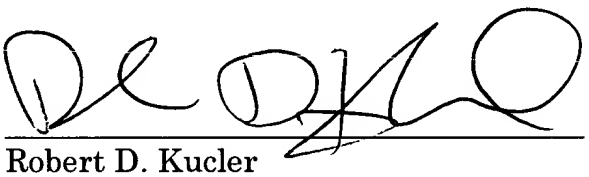
Obviousness of Lamination

In the rejection of claim 62, the Examiner states: "it would have been obvious to the skilled artisan to laminate the particulate recording media of Jagannathan in order to provide increased strength to the substrate or to provide labeling." Since the tape produced in this invention does not include a substrate, we would contend that lamination to provide increased strength to something which does not exist is not obvious. However, the act of laminating a particulate is not only obvious, it is the express purpose for which almost all particulate tapes are produced. A particulate tape is most often used as a production intermediate in the manufacture of laminated multilayer devices and structures. However, the lamination of an electrophoretically formed component of a particulate tape to another surface prior to its removal from the carrier on which it was formed, cannot be considered obvious.

The above amendments and accompanying remarks address each and every concern raised by the Examiner in the Office Action. Based on these clarifying amendments, Applicants believe that all claims of the present invention are now in condition for final allowance. Each of these amendments is fully supported throughout the specification, and no new matter is introduced by these amendments. If the Examiner feels that any issues remain outstanding, the Examiner is encouraged to contact Applicant's attorney at the contact information below.

Respectfully submitted,

Dated: September 3, 2004

By 

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